



FOREST HEALTH PROTECTION Pacific Southwest Region

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Preliminary Recommendations for Lost Horse Project Amador Ranger District, Eldorado National Forest

This memo summarizes discussions on November 20, 2008 between Beverly M. Bulaon (South Sierra Shared Service Area, entomologist), Marc D. Young (District Forester), and Bob Carrol (District Silviculturist) concerning stand conditions and potential management in the Lost Horse project area, Amador Ranger District, Eldorado National Forest.

The project proposes to conduct fuel reduction and forest health improvement treatments on 1454 acres between the areas of Foster Meadow and Mehrten Springs Road (UTM 10 S 740583 m E 4278766 m N). A large percentage of the project area is red fir type, but does include lodgepole pine groups surrounding Foster Meadow. One project objective is to “promote health forest stands that are resistant to drought, insects, and disease” (Lost Horse project **initiation letter** 2008). Proposed treatments in 619 acres of natural stands are to remove selected trees between 9-30 inches to reduce stocking, remove all trees less than 4 inches to reduce fuel levels. Forest Health Protection was only requested to consider treatments in the red fir habitats, but was not able to conduct further ground surveys due to time constraints. Therefore, the following discussion summarizes past research and recommendations concerning fir engraver, red fir dwarf mistletoe, and Annosum root disease which FHP hopes will be helpful when developing strategies to manage red fir stands within the project area.



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Biology

California red fir (*Abies magnifica* var. *magnifica*) is the predominant species of plant communities in the Eldorado National Forest. Potter (1998) thoroughly described the habitat and associated vegetation of red fir in the upper montane of the Sierra Nevada. Stands are typified as fairly dense, closed canopied, and composed of large diameter trees. Other tree species intermix with red fir depending upon elevation, soil type, and environment; however, red fir can be the singular dominating species typed instead with forbs or shrubs.

The most influential historical disturbances in red fir communities of California since the turn of the century have been wildfire suppression efforts and livestock grazing (Potter 1998). Wildfires were and are still mandated to be controlled in areas of urban interface for public safety, and general forests except for wilderness. Suppression activities have forestalled necessary disturbances that reduce competition between trees, thus maintaining sustainable stand densities. Grazing allotments have steeply decreased or were simply restricted within the past decades on federal lands, but consecutive years of intensive grazing a century before have left many areas completely altered or unable reestablish their former community structure. The current state of many red fir forests in the Eldorado is overstocked, with mortality levels higher than what would be acceptable for presumably endemic levels.

Insects and Pathogens are natural disturbance factors in the Sierra Nevada that strongly influence forest composition, structure, and function (Oliver 1996). However, past and recent human land management practices, including the two previously mentioned, have created large expanses of forests that are highly susceptible to bark beetle attack (Fettig *et al* 2007). The prevalence of Annosum root disease (*Heterobasidium annosum*) throughout California has been primarily attributed to: fire suppression activities that have allowed host fir type to proliferate through former pine types, and increase of tree harvesting that led to the abundance of stumps prime for disease establishment (Otrosina and Ferrell 1995).

Fir engraver (*Scolytus ventralis*) is the primary bark beetle that attacks true firs in California (Furniss and Carolin 1977) and has been active in scattered pockets throughout the Eldorado. Fir engraver damage is typified as either top-kill, random attacks on the bole, or whole tree mortality. While typically not an aggressive damage agent, repeated attacks of fir engraver on trees assist in degrading tree vigor or hastening decline from predisposing pathogens. Top kill promotes disease infection or breakage from environmental factors, again compounding overall tree stress. Fir engraver is most often found in conjunction with trees previously infected with root disease, but can become a direct mortality agent if host trees are significantly weakened and vulnerable to successful attack. During a recent drought event in the Sequoia National Forest, fir engraver caused widespread mortality, killing up to 80% of host type and attacking all size classes (Bulaon *et al* 2005).

The incidence of Annosum root disease in the Eldorado is considered to be fairly ubiquitous wherever past logging had occurred. In the past century “high grading” had been a common forest practice that targeted removing preferred ponderosa pine and leaving white firs. Affected stands have converted largely to white fir, in the overstory and regeneration. This lack of species diversity perpetuates Annosum root disease in the stand, increasing the size of infection centers due to the high availability of hosts. On the Georgetown Ranger District in

white fir stands around Nevada Point Ridge, annosum conks were detected in many every old stumps (MacKenzie *et al* 2009). Root disease centers were easily identifiable: trees displaying symptoms of infection with thinning crowns, standing snags, blow-down with laminated decay, and recently dead standing trees all radiating from the older (infected) stumps in the center

Currently, Eldorado County is experiencing a third year of record-setting drought (US Drought Monitor, <http://www.drought.unl.edu/dm/monitor.html>, March 3, 2009) which may be contributing to continued activity of pests on the Forest. Aerial detection surveys since 2006 have found large areas with fir engraver activity as well as other general bark beetle-associated mortality within the Lost Horse Project boundaries (see Appendix A). In other areas of the Eldorado, fir engraver activity has been increasing in red fir communities, but trends in host selection have not been clarified. Annosum root disease has been confirmed to be the predisposing agent in several gap openings in the Georgetown Ranger District (MacKenzie *et al* 2009). Along sections of Highway 88, mature red firs heavily infected with dwarf mistletoe are easily visible. Fir engraver damage was found most often near root disease centers, but appeared to be secondary agents.

Drought severely limits water resources, especially to high elevation species that require significant amounts of precipitation. Recurring drought events in California exacerbate current stress associated with overstocking. Bark beetles can respond quickly to changes in host conditions, thus risk of bark beetle infestation surges during drought years. Historical outbreaks have repeatedly followed drought peaks (Smith 2007), and most control efforts during outbreaks were ineffective. High risk for fir engraver begins when average annual precipitation drops below 54 inches in white fir communities (Felix *et al* 1971). Even if precipitation levels return to average levels, bark beetle-associated mortality may still continue for some years as trees struggle to regain lost growth and vigor.

The Lost Horse Project

Sites visited in November were predominantly red fir type, except near Foster Meadow where lodgepole pine is encroaching inward into the meadow. Stand structure was multi-storied and densely stocked. Basal area estimations were between 250-400 square feet per acre. Older stands (trees averaging >20 inches DBH) had tightly closed canopies with little vegetation in the understory. Larger openings did not appear to be successfully regenerating quickly, but some seedlings were clumped in tight groups close to stand edges. One of the largest openings was a site previously logged, and no borate treatment was applied to cut stumps. Stumps were not destructively sampled during the visit, but did indicate possible Annosum infection due to the deterioration pattern of the xylem rings. Insect damage was very minimal in all observed stands, and older tree mortality (by any agent) was not prevalent. Dwarf mistletoe infection appeared low to moderate in all size classes, but that was ocular estimation only. Smaller pole sized trees were observed with full crowns, but closer inspection found dwarf mistletoe infections starting on branches and boles. Trees appeared to be vigorously growing in the project with full crowns and little deformity.

According to Fowells (1965), mature climax red fir communities are naturally very dense, fully closed canopied, with one of the highest stand density indexes (Reinecke 1933). Potter (1998) repeatedly emphasizes caution when implementing any management in red fir communities due

the lack of information on subsequent effects from treatments. Conditions for red fir may already be optimum for growth and stocking currently in the Lost Horse project, and little may need to be done for improvement. However, due the recent catastrophic wildfire events (natural and man-caused), and predicted drought cycles to continue in California, then some management may be beneficial to preventing widespread tree loss when disturbances occur. Dwarf mistletoe and Annosum root disease can possibly be the most serious issues in the project, but their prevalence and severity should be confirmed before deciding upon management strategies. Regardless of objective, all treatments should compliment the larger effort of creating diversity and heterogeneity across the landscape

A recommendation for prioritizing white fir stands for treatment – those that do not already have active beetle infestations – is to use mean annual precipitation data to determine the pest risk (Schultz 1994). Estimating precipitation for locations may help land managers determine which stands would be most at risk during drought periods. Those with the lowest would be highest risk, while the highest mean precipitation would be lowest. This rating system may be applicable to red fir which is similar in its physiological characteristics as well as primary damage agents to white fir. Trees to be selected for removal should use risk-rating systems that examine crown condition (Ferrell 1989), but trees that have high Hawksworth's Dwarf mistletoe ratings (Hawksworth 1979) of 4 or greater, or visible damage from insect attack should be factored into selection.

Vegetation strategies for preventing bark beetle infestation in red fir communities have not been studied extensively to pinpoint risk thresholds; however, Ferrell *et al* (1993) determined that high basal areas and proportion of fir component in stands significantly improve risk predictions, especially during drought periods. Therefore, treatments that encourage healthy tree growth and improve overall stand conditions compliment objectives for reducing attack susceptibility. Thinning to slightly below normal basal area should reduce risk while enhancing stand resiliency to potential climate changes in the long-term.

Treatments to eliminate Annosum root disease centers are expensive, but can help accomplish other project objectives. It has to be first ascertained that the stand is heavily infected with the "S" type of annosum root disease. The "S" type is not capable of infecting newly planted pine species. This action implemented in Annosum root disease pockets would serve to revegetate with non-host types, as well as increasing the frequency of rust-resistant pollen into the forest. Based on other FHP surveys, the predominant annosum root disease on the Eldorado National Forest is the true fir killing "S" type. Additionally on the forest, Douglas fir is resistant to annosum root disease and thus this species should be conserved in root rot pockets. Small group selection in badly diseased stands may be both feasible, and provide an opportunity to plant rust-resistant sugar pines. Root disease treatments can be focused to isolated patches where pest presence has been confirmed, and the heaviest infested dwarf mistletoe trees should be removed to mitigate dissemination.

While treatments to eliminate Annosum root rot pockets may be expensive there is a relatively inexpensive method to stop new pockets developing in adjacent stands. This method involves the use of the registered pesticide Sporax®. While line officers have the authority to make the final decision to apply or not to apply Sporax®, our experience of forest health conditions on

the Eldorado would strongly support the decision for application. FHP professionals are available to survey individual stands to generate the data needed for line officers to make decisions on a stand by stand basis. While the decision to use Sporax® might involve a more complex NEPA documentation, FHP are available and willing to provide the supportive NEPA documentation needed to facilitate the use of Sporax®.

Possible fluctuations in global climate should be considered for long-term adaptability of the resulting forest to withstand changes; in addition to reaching desired conditions that do not require repeated costly and impractical treatments in the short-term. As stated in FSM 2000, Chapter 2020.2: Objectives: “Healthy, resilient landscapes will have a greater capacity to survive natural disturbances and large scale threats to sustainability, especially under changing and uncertain future environmental conditions, such as those driven by climate change and increasing human uses.”

The red fir stands in the Lost Horse project should be more thoroughly examined for incidence of insects and diseases. If pest conditions warrant treatment, then more detailed information can be provided by FHP to assist with management directives. If not, then an alternative of no-action should be considered and acceptable mortality levels established until pest conditions change.

It was a pleasure to talk with Mark and Bob concerning this important project. Please do not hesitate to contact South Sierra Shared Service Area if further information is needed.

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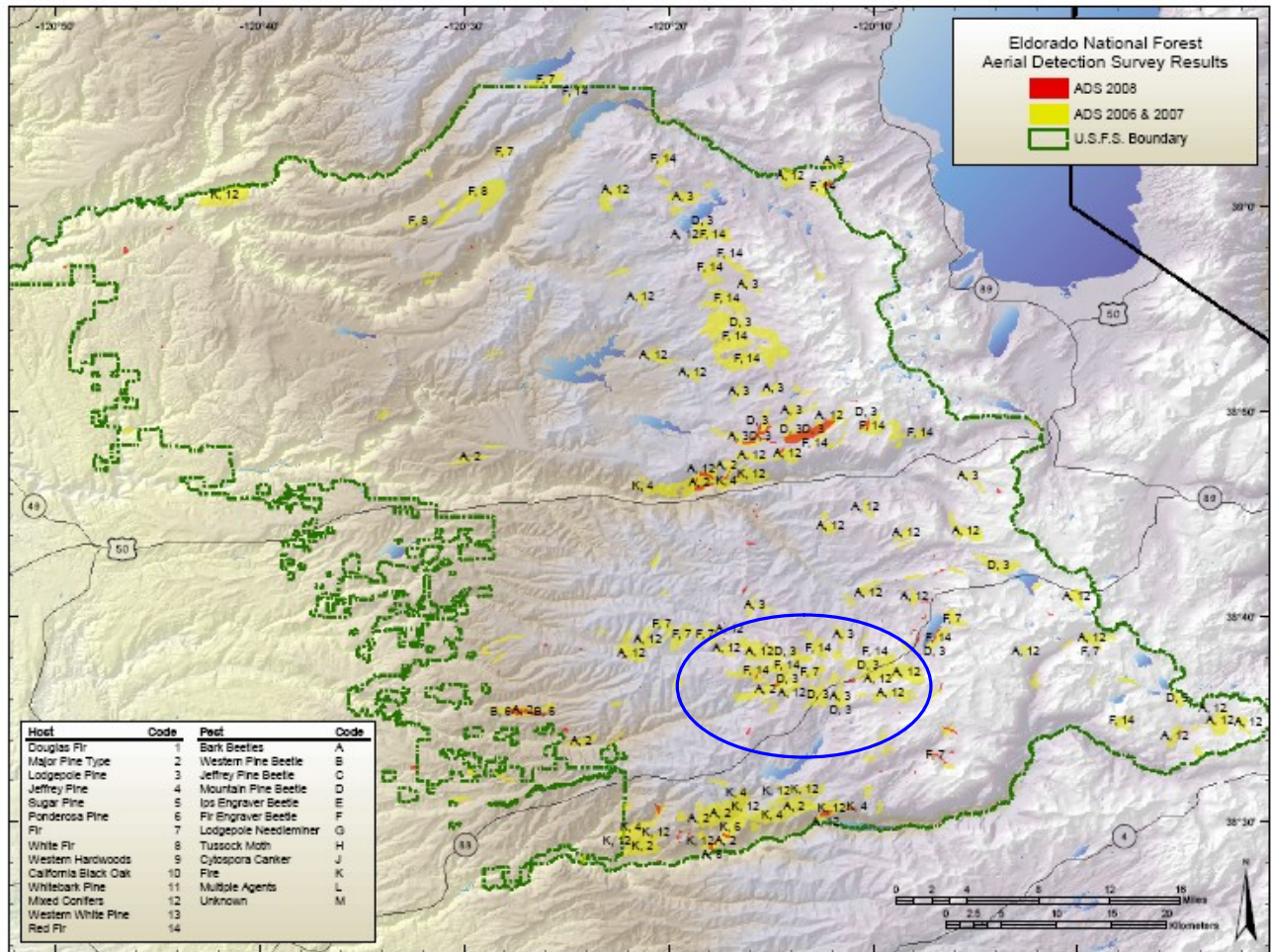
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Appendix A. Forest Health Protection Aerial Detection Survey 2006-2008 showing damage polygons detected in the Eldorado National Forest. The blue circle shows the approximate location of the Lost Horse project. Note the significant amount of damage occurring in those areas due to various agents.